Post Survey Report

Vessel Name: Celtic Voyager **Call Sign:** EIQN

Type of Vessel: Research Vessel

Cruise Name: Environmental Survey of Coastal and Shelf Waters – Northabout winter nutrients, benthos and contaminants monitoring.

Cruise Code: CV14001

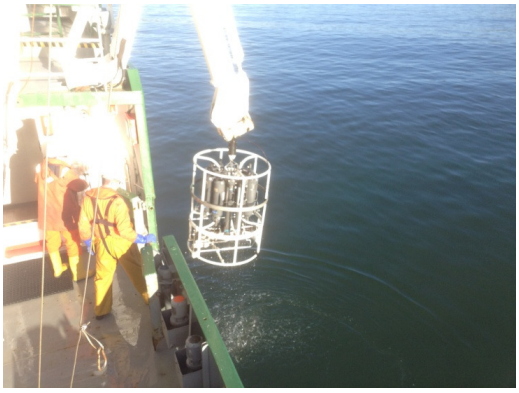
Start Date: 20/01/2014 **End Date:** 31/01/2014

Port of Dept: Howth **Port of Return:** Galway

Responsible Organisation

Name: Marine Environment & Food Safety Services, Marine Institute

Address: Rinville, Oranmore, Co. Galway



1. Introduction & Rationale

The 2014 survey continues the Marine Institute's Winter Nutrients monitoring that commenced from 1990 . The survey evolved during this time period with respect to parameters and sampling strategy. In 2011 this survey was reestablished as a winter environmental survey with a broader remit to provide supporting information for OSPAR and Water Framework Directive (WFD- Directive 2000/60/EC) assessments and also to maintain the winter time series on key biogeochemical parameters in in Irish waters in response to pressures such as land based inputs of nutrients and climate change. The 2014 survey was designed to collect multidisciplinary information on physics, water chemistry (dissolved nutrients, dissolved oxygen, carbonate parameters (TA, DIC), dissolved trace metals, dissolved organic carbon and total organic carbon, salinity), sediment chemistry (persistent organic pollutants POPs and trace metals), sediment particle size distribution and benthic macroinvertebrates. Additional sediment samples were taken for a GMIT project on microplastics. This contributes to data collection needs of various statutory drivers (WFD and the Marine Strategy Framework Directive (MSFD) Directive 2008/56/EC) as well as providing a research dataset on status and changing conditions (trends and variations) for key environmental variables. Previous winter nutrient surveys for the Irish Sea in the 1990s were extended into the Celtic Sea and coastal waters of the west coast in recent years. The current annual surveys alternately survey northabout and southabout (2011 & 2013 southabout, 2012 and 2014 northabout) thus providing a complete coverage of Irelands coastal waters over 2 year periods. However, given the timing of the surveys, winter by necessity to ensure minimal biological activitiy and therefore highest concentrations of dissolved nutrients, the weather is a significant factor in determining the actual as opposed to planned coverage of the target stations.

2. Objectives

A) *Winter Nutrients Survey*: The survey aims to fulfil Ireland's requirements under the Joint Assessment and Monitoring Programme (JAMP) of the 1992 'Oslo Paris Convention for the Protection of the North East Atlantic' (OSPAR). This requires the answering of 3 key questions:

1. What is the spatial distribution of winter nutrients in Irish coastal and shelf waters?
2. Are nutrient concentrations changing over time (trends)?
3. Are nutrient concentrations significantly elevated in coastal waters (>50%) above salinity related and/or regionally specific background levels and what are the background concentrations?

Coastal nutrient data are provided to the EPA and to support assigning *ecological status* to coastal water bodies in accordance with the requirements of the Water Framework Directive (Directive 2000/60/EC)

Offshore nutrient profiles in shelf waters contribute to determining long term variability which can be influenced by climate change related processes

As weather down time frequently disrupts coverage of Winter Surveys in a vessel of the size of the *RV Celtic Voyager* the sampling plan assigns a priority ranking to the stations.

B) *Collect sediment samples for assessment of hazardous substances in the marine environment*:

- obtain sediment samples to be used for trend analysis (Dublin Bay & Irish Sea) for organic and inorganic hazardous substances (OSPAR CEMP, WFD).

C) *Conduct Water Framework Directive monitoring (Dir 2000/60/EC) and provide supporting information for the implementation of the Natura Directives (Habitats Directive 92/43/EEC).*

- Collect samples to provide data to contribute to classification of WFD (client EPA) ecological status of selected water bodies for physico-chemical (nutrients, DO) and benthic macro-invertebrate ecological quality elements in a select number of waterbodies in the Irish Sea and North Western coastal waters.
- Using benthic invertebrates and associated sediment information (Particle Size Analysis) the survey will be able provide additional habitat distribution data (ground truth data) for a variety of Natura sites along the Eastern and Southeastern Seaboard.

D) *Collect samples for measuring carbonate system parameters (DIC, TA, pCO_{2calc} and pH_{calc} in coastal waters to contribute to baseline dataset for these variables*.

E) Collect samples for measuring levels of dissolved trace metals in coastal and shelf waters.

- Pilot sampling to assess methodology for surface sampling seawater for dissolved trace metals from Celtic Voyager. Data to contribute to WFD assessments and characterization of trace metal concentrations in offshore/shelf areas (MSFD)

F) Collect samples for determination of microplastic abundance in coastal sediments

- These samples were collected on behalf of GMIT PhD Project. It is anticipated that this project will contribute data to support assessments under the MSFD

3. Personnel

Scientific complement

Role: Chief Scientist
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Name: Brian Boyle (BB) - Chemistry
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Email: brian.boyle@marine.ie

Crew: Master and 6 crew**.** **Master** Colin McBrearty

Tech support: Anthony English

4. Methods & Protocol

4.1. Equipment Listing

4.1.1. CTD Profiler and Rosette Sampler
Make: Seabird SBE 911
Model: SBE 911plus

Sampling Protocols - CTD deployed at designated stations and times. Data collected from temperature, conductivity and pressure sensors. Water samples for nutrients, DO, DIC/TA and DOC/TOC were were collected at most stations from the maximum depth reached and surface (~ 3 metres) using niskin bottles (5L). Water samples for metal testing were collected using 2.5L? GO-FLO bottles. GO-FLO bottles were acid cleaned in the laboratory and tested for contamination in advance of the survey

Also deployed on frame was Wetlabs fluorometer, transmissometer, DO Sensor (see sect 5)

4.1.2. Fluorometer
Make: Wetlabs
Model:
Sampling Protocols - OSS fluorometer deployed on CTD frame

4.1.3. Transmissometer
Make:
Model:
Sampling Protocols - Deployed on CTD frame

4.1.4. DO sensor
Make: Seabird
Model: SBE-43
Sampling Protocols - Deployed on CTD frame

4.1.5. On board Seawater Pump
Make:
Model:
Sampling Protocols: The seawater pump was used to collect surface water at all underway stations.

4.1.6. Data were also generated by underway fluorometer, onboard ADCP and MDM 400.

4.1.7. Reineck Box Corer
Make: Reineck
Model:
Sampling Protocols: Sediment samples were taken for contaminant monitoring: Surface sediment was transferred into glass and plastic bottles for organic and inorganic analysis respectively. Sampling material in contact with the side of the grab was avoided

4.1.8 Grab sampler
Make: Day Grab
Model: P&O design

Sampling Protocols: Sediments were sampled for benthic infauna using Day grab. For the former sediment samples were removed from the grab and a small subsample retained (and frozen) for PSA and organic carbon analysis (LOI). The remaining sediment was sieved through a 1mm mesh sieve and fixed in formalin (5%). For the latter surface sediment removed using cleaned spatulas directly from the grab via the top lids and transferred into glass and plastic bottles for organic and inorganic analysis respectively. Sampling material in contact with the side of the grab was avoided

4.1.9 Shipek sediment grab sampler
Make: Shipek
Model:
Sampling Protocols: Not used

4.1.10 SCS system: The system was used to log sampling events with automated date, time and GPS stamping.

Equipment brought on board by scientific complement

4.1.11 DO Analysis – Metrohm Titrino
Sampling protocols: See 4.2

4.2. On-board processing

Water Samples - chemistry:

Surface Samples (~3m) from underway stations were collected for nutrients and salinity as below using the onboard pump. From CTD stations the following were sampled using Niskin bottles according to standard protocol and in the following order: Dissolved oxygen (Winkler), TA/DIC (selected stations), nutrients and salinity.

1. Samples for accurate salinity measurement: Unfiltered glass bottle stored at room temperature for subsequent salinity analysis. Samples will be measured subsequently in the Marine Institute using a Guildline Portasal salinometer
2. 2 x 50 ml PP tubes filled with water filtered through a 0.45µ cellulose acetate (acid-cleaned polycarbonate) filter and frozen immediately after collection for post-cruise nutrient analysis in the Marine Institute using a Skalar San++ autoanalyser.
3. DIC/TA samples collected at designated stations. Samples preserved with mercuric chloride (Dickson et al. 2007) Samples will be analysed post survey in NUI Galway/MI (or NOC UK) for DIC/TA using a Vindta-3C or Apollo system and methods of Dickson et al (2007).
4. DO samples: Collected immediately from Niskin bottles avoiding bubbles and fixed immediately on collection. Samples were analysed on board (Dickson, 1995), generally within 1 day of collection by the modified Winkler method with a Metrohm 848 Titrino Plus, and Metrohm combined Pt electrode for potentiometric endpoint determination.

5. Surface seawater dissolved trace metal samples were collected at selected stations using the pre acid-washed and contaminant checked (laboratory) GO-FLO bottles mounted on the CTD rosette. Samples were collected from the GO-FLOs into acid washed 1L plastic bottles. Approximately 50 mls are transferred to a new Fortuna plastic 2 piece syringe (no bung) and filtered though a cellulose acetate syringe filter unit. The first 5mls are filtered to waste and the remainder is collected in acid washed 100ml nalgene bottles containing 1 ml of concentrated nitric acid. The bottles are closed and stored on board at ~4°C. Samples will be analysed within 1 month at the Marine Institute using ICPMS.

Sediment Samples

Sediment Samples – marine chemistry:
Surface sediment was split between glass (solvent washed – for organic analysis) and plastic jars (acid washed –) and frozen immediately after collection.Samples will be analysed (<63u fraction) in the MI and additional specialist labs for a variety of persistent organic pollutants, trace metals and various cofactors.

Benthic Sediment Samples:
Sediment samples: At all benthic stationswhere suitable sediments could be sampled, a subsample of sediments (100-200g) was taken for Particle Size Analysis (PSA) and Loss on Ignition (LOI). The samples were labelled and stored in plastic zip-loc bags and frozen.

Macroinvertebrate samples: At each station sufficient sediment (>2.5L) was retained for faunal analysis. These samples comprised single Day grab samples. Upon retrieval all sediment were washed on a 1mm mesh sieve. All faunal and residue (e.g. sediment and shell matter) were retained and stored in a plastic container and fixed with V:V 4% neutral buffered formalin.

Sediment samples for microplastics
At benthic stations sediment 300 g subsamples of surface sediments were removed from grab and placed in double ziplock bags with the label in between bags. Samples were stored in box in the wet laboratory. These samples will be analysed in GMIT as part of a research project.

4.3. Equipment Issues

4.3.1 SCS system was used to log sample events at the chemistry sampling stations. The system was configured so that the computer in the onboard chemistry laboratory ran as a slave of the drylab computer. Apart from one crash requiring a restart, the system worked well. Paper records were not taken during this year's survey.
4.3.2 The salinity measurements from the underway thermosalingoraph were of varying consistency with CTD at given stations, though the very high bias of 2013 survey was not evident.
4.2.3 There were issues with underway flow at various times occasionally requiring repriming of the system. The UK Shelf Sea Biogeochemistry programme has proposed sampling DIC/TA from Ship's underway system on various research vessels. DIC/TA samples were taken from the underway at two stations on this survey alongside CTDs for comparison, (including samples collected while ship was moving to and from sampling station). This is to identify if there are obvious problems with sampling DIC through the underway e.g. associated with water/air exchange.
4.3.4 The CTD system failed twice. Following a failure on the outer station of the Dublin Transect 322 (lost communication). A temporary repair was effected and worked for some time. However the CTD again lost communication at the outer station of the Boyne transect (414). A re-termination was required. Continued work taking underway samples *in lieu* of CTDs at stations on this transect and in Carlingford Lough. The CTD was effectively repaired by the onboard technician and no more problems were observed during the remainder of the survey.

5. Narrative

Close to half of the allocated time was lost due to very poor weather conditions with a series of west moving Atlantic low pressures. The actual sampling plan was dictated by the weather conditions as in many cases wind speed, direction and sea conditions precluded offshore sampling whereas sheltered coastal stations could be sampled. The survey departed from Howth (Changed from Sir John Rogerson's Quay on 17th Jan) at 1000 of the 20th Jan. Following sampling in Dublin Bay area including sediment sampling for contaminant chemistry, the vessel proceeded South sampling Dublin and Wicklow transects. .

The following areas were sampled:

- water chemistry - coastal stations in the Irish Sea, Arklow, Dublin (incl TA/DIC), Boyne and Dundalk Transects transects in the Irish Sea; North Channel coastal stations including Ards-Galloway (including metals) and Mull transects. Lough Foyle, Lough Swilly including metal samples. Donegal coastal samples, Donegal Bay, (Inver, Killybegs, Sligo Bay), west coast (Mayo Sligo), Clew Bay and Galway Bay
- Sediment chemistry - sampled Dublin Bay and North Irish Sea sediment stations (contaminants)
- for benthic components – target areas North Dublin coastal waters, Dublin Bay, Inver Bay, Sligo Bay, Clew bay

Worsening weather conditions required the vessel to put into Derry in the afternoon of Fri 24th Jan. The vessel pulled away from Derry quays for second leg at 0800 of Tues 28th Jan. Weather also dictated coming in at the end of the survey a day earlier than planned (0600 31st Jan 2014)

Winter Nutrients: Due to the very poor weather conditions most of the offshore sampling stations in the west coast could not be sampled. 64% of CTD and 84% of underway stations achieved albeit for an ambitious programme with better coverage for priority 1 stations. Figure 1 shows the coverage achieved.

Surface samples for dissolved nutrients and accurate salinity were taken at all underway stations sampled and surface and bottom waters were sampled for CTD stations. Additional samples were occasionally sampled in the water column depending on the observed structure of the water column. DO samples were also collected at CTD stations and analysed on board (Winkler). Conductivity, temperature, DO and turbidity profiles were taken at CTD stations

Sediment samples were collected for hazardous substances analysis (trace organics and heavy metals) in Dublin Bay (2) and North Irish Sea (1) – trend stations samples were collected as per previous years

DIC/TA Samples ~ 70 samples were collected during following transects/bays: Irish Sea Arklow, Dublin Bay transect, Dundalk transect; Ards-Galloway transect; Mull transect; Lough Foyle, Clew Bay

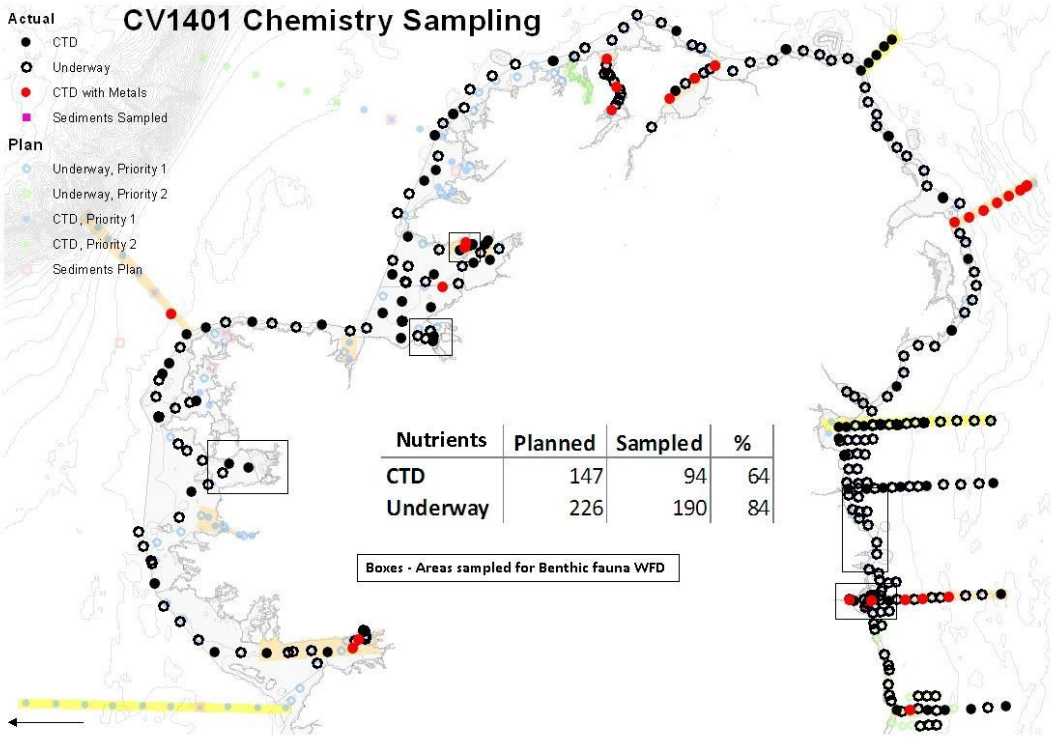


Figure 1: Stations sampled for winter nutrients(black) and stations not sampled (grey)

Benthic fauna: Benthic samples was sampled in, Dublin Bay, Northwest Irish Sea, Boyne Plume, McSwynes Bay, Sligo Bay and Clew Bay. Sub-Samples were retained for particle size analysis and loss on ignition. In addition, grab samples were sieved on a 1mm sieve and fixed in formalin (4%). In addition, sediment sub-samples were collected for microplastic testing at each benthic infauna sampling station.

See appendix for detailed narrative

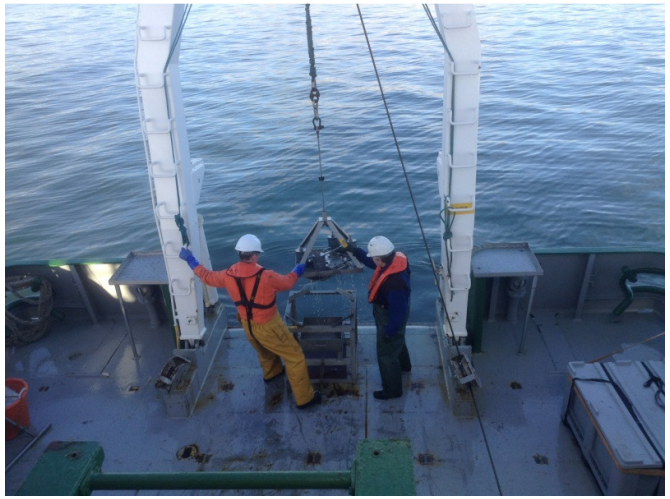
Table 1. Benthic sampling summary table.

Waterbody	Sample code	Way-point	Latitude (N)	Longitude (W)	Adjusted Site Depth	Sediment type	Plastics
Dublin Bay	**MIBE14-1**	**2**	53.3580	6.0653	14.6	sandy mud, shell and cobble	Yes
Dublin Bay	**MIBE14-2**	**3**	53.3554	6.1063	11.3	fine sand	No
Dublin Bay	**MIBE14-3**	**4**	53.3512	6.0933	11.3	fine sand	Yes
Dublin Bay	**MIBE14-4**	**5**	53.3475	6.1046	10.8	fine sand (amphiura and cockles)	No
Dublin Bay	**MIBE14-5**	**6**	53.3389	6.0995	13.3	coarse shelly mud	Yes
Dublin Bay	**MIBE14-6**	**7**	53.3318	6.1195	14.3	fine muddy sand	No
Dublin Bay	**MIBE14-7**	**8**	53.3260	6.1280	10.7	fine sand	Yes
Dublin Bay	**MIBE14-8**	**9**	53.3144	6.1277	11.3		Yes
Dublin Bay	**MIBE14-9**	**10**	53.3093	6.1118	13.3	fine sand	Yes
Dublin Bay	**MIBE14-10**	**11**	53.2977	6.0941	15.4	fine sand	No
Dublin Bay	**MIBE14-11**	**12**	53.3079	6.0877	22.0	sandy mud (amphitrite, sea potatoes)	No
Dublin Bay	**MIBE14-12**	**13**	53.3211	6.0982	14.5	sand	Yes
Dublin Bay	**MIBE14-13**	**14**	53.3373	6.0848	10.7	fine sand and shell	Yes
Dublin Bay	**MIBE14-14**	**15**	53.3288	6.0724	16.5	no sample (3 grab attempts - rock and cobble)	No
NWIS	**MIBE14-15**	**16**	53.4570	6.0997	9.8	muddy sand	No
NWIS	**MIBE14-16**	**17**	53.4856	6.0825	12.4	coarse sand and shell	Yes
NWIS	**MIBE14-17**	**18**	53.4769	6.0414	8.8	fine sand	No
NWIS	**MIBE14-18**	**19**	53.4720	6.0243	14.3	fine sand	No
NWIS	**MIBE14-19**	**20**	53.4803	5.9917	33.1	sand mud and shell (mixed)	Yes
NWIS	**MIBE14-20**	**21**	53.4989	5.9858	39.2	coarse sand and gravel	No
NWIS	**MIBE14-21**	**22**	53.5082	6.0218	12.3	fine sand	No
NWIS		**23**	53.5020	6.0745	12.8	no sample (2 grab attempts - rock and cobble)	No

Waterbody	Sample code	Way-point	Latitude (N)	Longitude (W)	Adjusted Site Depth	Sediment type	Plastics
NWIS	**MIBE14-22**	**24**	53.5315	6.0587	13.4	fine sand with shell hash	No
NWIS	**MIBE14-23**	**25**	53.5500	6.0580	13.0	muddy fine sand (bivalves and brittlestars)	Yes
NWIS	**MIBE14-24**	**26**	53.5676	6.0648	11.3	fine sand	No
NWIS	**MIBE14-25**	**27**	53.5796	6.0561	18.1	coarse sand and shell	Yes
NWIS	**MIBE14-26**	**28**	53.5861	6.0470	23.6	coarse pebble and mud	No
NWIS	**MIBE14-27**	**29**	53.5966	6.0584	26.4	mud and pebble	No
NWIS	**MIBE14-28**	**30**	53.5986	6.0838	9.5	fine sand	No
NWIS	**MIBE14-29**	**31**	53.6017	6.1009	7.7	fine sand	Yes
NWIS	**MIBE14-30**	**32**	53.6130	6.1252	7.0	fine sand	No
NWIS	**MIBE14-31**	**33**	53.6237	6.1382	10.6	fine sand	Yes
NWIS	**MIBE14-32**	**34**	53.6321	6.1559	10.4	muddy sand	No
NWIS	**MIBE14-33**	**35**	53.6457	6.1628	12.2	muddy sand	Yes
NWIS	**MIBE14-34**	**36**	53.6611	6.1887	10.5	fine sand	Yes
NWIS	**MIBE14-35**	**37**	53.6795	6.1938	10.8	sand with mud	No
NWIS	**MIBE14-36**	**38**	53.6969	6.2003	11.5	sand	No
NWIS	**MIBE14-37**	**39**	53.7106	6.2055	11.3	sand	No
Boyne Plume	**MIBE14-38**	**40**	53.7193	6.2073	10.9	fine sand	Yes
Boyne Plume	**MIBE14-39**	**41**	53.7255	6.2067	11.4	fine sand	Yes
Boyne Plume	**MIBE14-40**	**42**	53.7294	6.2076	11.2	fine sand	Yes
Boyne Plume	**MIBE14-41**	**43**	53.7330	6.2076	11.5	fine sand	Yes
McSwynes Bay	**MIBE14-42**	**44**	54.5990	8.4492	31.9	coarse sand	Yes
McSwynes Bay	**MIBE14-43**	**45**	54.6001	8.4455	31.7	muddy sand	Yes
McSwynes Bay	**MIBE14-44**	**46**	54.6010	8.4410	30.8	muddy sand	Yes
McSwynes Bay	**MIBE14-45**	**47**	54.6015	8.4327	30.3	muddy sand	Yes

Waterbody	Sample code	Way-point	Latitude (N)	Longitude (W)	Adjusted Site Depth	Sediment type	Plastics
McSwynes Bay	**MIBE14-46**	**49**	54.6010	8.4222	30.1	muddy sand	Yes
McSwynes Bay	**MIBE14-47**	**50**	54.4192	8.4102	30.6	muddy sand	Yes
McSwynes Bay	**MIBE14-48**	**51**	54.6113	8.3953	25.8	mud and shell	Yes
McSwynes Bay	**MIBE14-49**	**52**	54.6114	8.3523	25.4	mud	Yes
McSwynes Bay	**MIBE14-50**	**53**	54.6110	8.4124	27.8	mud	No
McSwynes Bay	**MIBE14-51**	**54**	54.6081	8.4270	29.2	muddy sand	No
Sligo Bay	**MIBE14-52**	**55**	54.3265	8.7180	30.4	Sand	Yes
Sligo Bay	**MIBE14-53**	**56**	54.3185	8.6864	31.3	3 attempts no grab	No
Sligo Bay	**MIBE14-54**	**58**	54.3029	8.6562	18.3	sand	Yes
Sligo Bay	**MIBE14-55**	**59**	54.2937	8.6433	16.7	sand	Yes
Sligo Bay	**MIBE14-56**	**60**	54.2809	8.6422	14.9	sand (Donax sp.)	Yes
Sligo Bay	**MIBE14-57**	**61**	54.2818	8.6579	17.1	sand (Donax sp.)	Yes
Sligo Bay	**MIBE14-58**	**62**	54.2966	8.6653	17.0	sand	Yes
Sligo Bay	**MIBE14-59**	**63**	54.3076	8.6746	22.5	sand	Yes
Sligo Bay	**MIBE14-60**	**64**	54.2986	8.6849	22.4	sand	No
Sligo Bay	**MIBE14-61**	**65**	54.2851	8.6863	22.9	sand	No
Sligo Bay	**MIBE14-62**	**66**	54.2834	8.7117	33.0	sand (with little fauna)	No
Sligo Bay	**MIBE14-63**	**67**	54.2957	8.7057	24.6	sand	No
Sligo Bay	**MIBE14-64**	**68**	54.2973	8.7331	24.4	sand	No
Sligo Bay	**MIBE14-65**	**69**	54.2864	8.7337	23.5	sand	No
Clew Bay	**MIBE14-66**	**70**	53.8539	9.9134	25.0	sand	Yes
Clew Bay	**MIBE14-67**	**71**	53.8470	9.8695	24.3	sand	Yes
Clew Bay	**MIBE14-68**	**72**	53.8606	9.8361	21.6	sand	Yes
Clew Bay	**MIBE14-69**	**73**	53.8813	9.7965	15.0	fine sand	Yes
Clew Bay	**MIBE14-70**	**74**	53.8633	9.7866	26.9	sand	Yes

Waterbody	Sample code	Way-point	Latitude (N)	Longitude (W)	Adjusted Site Depth	Sediment type	Plastics
Clew Bay	**MIBE14-71**	**75**	53.8271	9.7437	27.2	fine sand	Yes
Clew Bay	**MIBE14-72**	**76**	53.7984	9.7341	25.3	fine sand	Yes
Clew Bay	**MIBE14-73**	**77**	53.8288	9.8408	33.7	sand (with shell)	Yes
Clew Bay	**MIBE14-74**	**78**	53.8290	9.8941	38.7	fine sand	No
Clew Bay	**MIBE14-75**	**79**	53.8057	9.8970	29.3	fine sand	No
Clew Bay	**MIBE14-76**	**80**	53.8067	9.8452	34.5	fine sand	No
Clew Bay	**MIBE14-77**	**81**	53.7833	9.8446	15.3	sand	No
Clew Bay	**MIBE14-78**	**82**	53.7821	9.8758	17.7	sand (with pebbles)	No



6. Preliminary Findings

With the exception of Winkler DO analysis which is carried out on board and in situ measurements, sample analysis/processing is carried out in the marine Institute laboratories post survey (salinity, nutrients, TA/DIC, benthic, sediments). Data will be available via Marine Institute data request system (www.marine.ie).

The surface CTD salinity measurement and DO probe will be checked against laboratory (bottle) salinity measurements carried out using an INAB (ISO 17025) **accredited** method on the portasal salinometer.

7. Conclusions & Recommendations

Effective completion of the cruise objectives.
The survey was reasonably successful given weather conditions. Over 64% of water stations were completed with good coverage of inshore coastal stations in particular. Sediments for OSPAR Hazardous Substance monitoring were acquired at all target stations and seawater samples were collected for trace metal testing. Benthic sampling was completed for all the priority areas targeted. DIC/TA samples were collected on 7 transects/areas.

The scientific team would like to thank the master (Colin McBrearty), and all of the crew and Technical support (Anthony English) for their excellent support and help over the course of this survey.

Appendix 1: Survey log

Cruise Narrative Annual Environmental Survey 2014
Annual Winter Environmental Monitoring Survey Northabout 2014. 20th Jan (Howth) – 31st Jan (Galway)
Crew: Master: Colin McBrearty, **Tech P&O**: Anthony
Scientific Complement – *CS* –Evin McGovern (0600-1200, 1800-0000), *Chemistry* Triona McGrath, Tom Szumski (1200-1800, 0000-0600), Brian Boyle (0600-1200, 1800-0000), Brendan McHugh (1200-1800, 0000-0600). *Benthic*: Francis O'Beirn,

Notes	Station
Sun 19th Jan 2014. Mobbed and full scientific complement joined ship in Howth ***Mon 20th*** Pulled away from Howth at *10:00*. Commenced sampling in Dublin Bay- benthic, microplastics in sedment for GMIT, nutrient stations, transect from East Link Nutrients, DIC/TA, trace metals in water	
2 sediment box core samples collected (stations 9002/9003)	
2 station 619 marked on chart (CTDs – 1 Dublin Bay and 1 North Skerries) Dublin Bay not on map.	619 (1)
Station 610 sampled by CTD for DIC/TA	610
Bottle no 6 not firing: firing seqeunce 1-3 bottom (1 gases, 2 nutrients), 4 -7 surface (4 gases, 5 nuts, 7 spare), 8-9 go-flo metals (not primed until arrival at stations – samples taken from no 8	
Station 59 neither Go-Flo fired correctly. No samples for trace metals	59
Communication lost with CTD on starting ascent for outer station (322) at Dublin Bay. 126 m depth. Problem identified with the termination. Temporary repair effected but took station as an underway instead of CTD and continued to station 419, (outer station of Wicklow transect)	322
Tues 21st CTD operating ok station 419. Weather deteriorating. Continued Wicklow transect in poor weather conditions (Southerly gales). Carbon and metals samples were not planned but taken at most CTD stations. CTD station 83 we drifted 1 mile N during deployment. Took 1 hour to steam back to CTD station (1 knot against tide and current) so, given weather and time constraints, abandoned 3 steamover stations to south (90 – 92), and continued east to finish the transect. Continued N picking off coastal stations and stations not collected in Dublin Bay during initial sampling. *Tues 21st pm*. Commenced benthic sampling in coastal waterbodies north of Dublin. Sediment samples also collected for microplastics. Second Station on map as 619 (labeled on bottles as N of skerries). To correct numbering for 2015. Commenced Boyne transect	419
	619(2)
Wed 22nd Jan *04:40* Station 414 outer Boyne transect CTD comms failure. Took underway sample and sailed north to station 448 (end station of Dundalk transect). Awaited initial troubleshooting results. This indicated retermination was required (at least 5 hours so decision taken to continue working west along the transect taking underway samples *in lieu* of CTDs for nutrients.	414
Continued to station 10 on transect and then heaved to to await the pilot for Carlingford Lough	10
09:20 Station 11- underway – flow rates slow and intermittent (subsequently fixed)	11
10:10 Carlingford pilot joined vessel. Went into carlingford taking 3 samples as underways and 1 at exit (4). Two of the samples would normally be CTDs. Sampling water stations in Dundalk Bay and North of Boyne. Station 10 logged in error a second time but no sample taken	
CTD working again Working Dundalk Bay. CTD 623 moved as too shallow and CTD 624 combined with Station 6 and logged as 624 Coastguard helicopter joined us for an exercise landing two men and a stretcher on the aft deck of the vessel moving at full speed	622
Worked out Dundalk transect to station 9. Continued along transect collecting CTDs at CTD stations 11, 13 and 16 where underways taken earlier. Sampling for nuts, DO, and TA/DIC. Underway nutrient stations not resampled	11,13, 16

16

At Station 16 tested the underway system for DIC/TA. Samples collected via same sampling tube used for CTD on approaching station, at station (CTD also taken) and on steaming from station. Aim was to see how DIC via underway intake was affected by vessel movement (hull turbulence) and compare results to CTD standard sampling. Jason had looked at system earlier to remove bubbles and there was no obvious evidence of bubbles in debubbler.. Nutrients and salinity also taken.

After station 16 steamed back to Co Down coast to pick up steamover and CTD stations

Thurs 23rd Jan Changed shift at 0000 after sampling station 631 631

02:55 started the Ards-Galloway transect. All stations are CTDs Sampling Nutrients, Carbon, and metals (surface only) 639

06:00 problems with nutrients filtration pump…low vacuum. Seemed to sort 16tself out. Last station on the Galloway transect….Weather poor …return into 50kt winds 645

*13:10*Hove to after station 666 waiting for winds to die down a little before commencing Mull transect at *15:09* All stations are CTDs Sampling Nutrients, Carbon, 666

*17:37*Completed last station on Mull Transect 671

Changed shift. Meeting with Master and concluded necessary to go into Derry in advance of storms forecast. Pilot booked by master.

Returned to station 666 to await winds backing south before sampling along northern coast. Recommenced at *2130* continuing to station 672 672

Fri 24th Jan Bottle 3 damaged on Carousel so removed. Fired bottle 1,2,4 at the bottom and 5,7, 10 for surface. 10 didn't fire and 7 missing on return presumed lost. DO and Carbon taken from bottle 5 for surface and bottle 1,3 for the bottom. Bottles 3 and 7 replaced. Completed the last underway station. Hove to to time entry for meeting pilot at 1000 676

679

Vessel underway

1st CTD station just at entrance to Lough Foyle outside Magilligan point. All bottles tested and firing correctly (except 6). CT samples Lough Foyle are for nutrients/DO, Carbon, DOC/TOC and Metals (surface only) Some structure on the water column thoughout Lough 680

Station 681 Marked as a CTD station taken as underway as so close to station 680. **Reassign for future surveys as underway** 681

09:50 Took on pilot at Greencastle

11:16 last CTD station 686 sampled and pulled into Derry docks shortly after. 686

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Tues 28th Jan 08:00 Pilot on board …pulled away from Derry Quay and pilot left at Greencastle *09:10*. Northern winds and Very heavy seas beyond Magilligan Point

1st sample of day taken after station point as underway had gone off, due to air in system, prob due to intake coming out of water 687

Lough Swilly. Inner Swilly station 711 past Rathmullan taken as a CTD station. 712 not collected 711

Mulroy Bay and Sheephaven not accessible and should be removed from future survey plans. Continued sampling coastal waters around Bloody Foreland

CTD strongish CT strification at 30-36m station 741 . Above 34.4 psu below 35.0 741

Wed 29th Jan Could not sample Gweebarra or Loughras stations in dark and given weather

Did not do NW - Donegal transect as time not available. Plan to do as much of Donegal Bay to be ready for grabs in McSwynes at 730

Stratification at 12m. Two carbuoys filled from underway as steaming from stations 743 743

Sampling McSwyne's Bay for Benthic Sediments, litter and Water

Station 891 on Max Sea twice - one in McSwyne's Bay (not on our chart) and 1 CTD in Killary. McSwyne's sample not taken not taken. Subsequently sampled in Killybegs harbour and sampling Inver Bay and Inner Donegal Bay 891

Breakage of some DIC/TA sample in fridge. SAmples had shifted and fell when opened…get a basket for holding samples in future survey?

Pm Commenced sampling Sligo Harbour for Benthic infauna

Subsequently continued sampling along North Mayo coast and Broadhaven Bay.

Thurs 30th Jan. Seawater samples for trace metal analysis collected using GoFlos at station 826. Blacksod Bay: 871 CTD moved south to centre channel. 869 and 874 dropped due to time restraints so as to get to Clew Bay to allow enough daylight for grabbing 826 871

Commenced sampling (benthic grabs and nutrients) in Clew Bay *13:00*. A number of close together benthic stations were consolidated due to weather window time constraints [others dropped due to access difficulties?]

Very heavy swell around Inisboffin and Slyne Head. Plan to do inner stations of 53N transect south of Aran Islands abandoned due to weather. Master decided that should head in for early tide as weather and forecast remain poor. CE also going in early and pilot available. Organised pilot for 0500 after CE. Lower 53N transect scrapped due to weather and gate restrictions

Worked in Galway Bay. Intense sampling of inner bay in plan revisited and a number of stations omitted (including outer stations along Southern shore of Bay) due to time constraints
31st Jan Took on pilot and docked at *06:00*. Demobbed and departed *10:45*. Samples transferred directly to MI for appropriate storage